Name: KEY

Period: _____ Table: _____

/ 16

General Physics
5.1 Work & Power
Worksheet

Answer the following questions - show your work...

Equations:
Weight = mg
$g = 9.8\ m/s^2$
Work = $F_{||}\ d$
Power = Work / Δt

1. Fluffy, a 1.5-kg cat climbs a tree and gets stuck on a branch that is 5 meters high. How much work did Fluffy do to get to that height?
Draw a free-body diagram.

Hints:
a) Find the Weight of Fluffy first
b) The Applied Force (F) is equal to the weight of Fluffy.

Rubric:
____ FBD
____ Data
____ Equation
____ Substitution
____ Answer
____ Units

$m = 1.5\ kg$
$d_V = 5\ m\uparrow$
$W = 14.7\ N\downarrow$
$F = 14.7\ N\uparrow$
PARALLEL

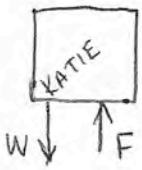
$W = mg$
$W = (1.5\ kg)(9.8\ m/s^2)$
$W = 14.7\ N\downarrow$

WORK = $F_{||}\ d$
$= (14.7\ N)(5\ m)$
WORK = 73.5 J

2. Katie, 30-kg little girl wants to rescue her cat from the tree, so she climbs the same height as Fluffy. Unfortunately, she, too, gets stuck. How much work does she do to get to the cat?
Draw a free-body diagram (FBD).

Rubric:
____ FBD
____ Data
____ Equation
____ Substitution
____ Answer
____ Units

Hints:
a) Find the Weight of Katie first
b) The Applied Force (F) is equal to the weight of Katie.



$m = 30\ kg$
$d = 5\ m\uparrow$
$W = 294\ N\downarrow$
$F = 294\ N\uparrow$
PARALLEL

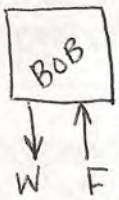
$W = mg$
$W = (30\ kg)(9.8\ m/s^2)$
$W = 294\ N\downarrow$

WORK = $F_{||}\ d$
$= (294\ N)(5\ m)$
WORK = 1470 J

3. Katie's dad, Bob, sees Katie and Fluffy in the tree. He's afraid of heights, so he runs in the house to get his phone to call 911. His mass is 85 kg. He runs 10 meters to the house and up the steps that are 1.4 meters high. He runs an additional 5 meters inside the house to get to his phone. How much work did Bob do to get to the phone? **Draw a free-body diagram.**

Rubric:
____ FBD
____ Data
____ Equation
____ Substitution
____ Answer
____ Units

Hints:
a) Find the Weight of Bob first
b) The Applied Force (F) is equal to the weight of Bob.



$m = 85\,kg$

$d_H = 10\,m + 5\,m = 15\,m$

$d_V = 1.4\,m$ ↑

$W = 833\,N$ ↓

$F = 833\,N$ ↑ PARALLEL

$W = mg$

$W = (85\,kg)(9.8\,m/s^2)$

$W = 833\,N$ ↓

$WORK = F_{||} d$

$= (833\,N)(1.4\,m)$

WORK = 1166.2 J

4. In no time flat, Jack, a 105-kg fireman, arrives at the scene. Katie and Fluffy are too high to use a regular ladder, so Jack climbs into his bucket lift. He is lifted up to Katie and Fluffy by the motor in the truck. How much work does the motor do to get Jack to Katie and Fluffy? **Draw a free-body diagram.**

Rubric:
____ FBD
____ Data
____ Equation
____ Substitution
____ Answer
____ Units

Hints:
a) Find the Weight of Jack first
b) The Applied Force (F) is equal to the weight of Jack.

$m = 105\,kg$

$d_V = 5\,m$ ↑

$W = 1029\,N$ ↓

$F = 1029\,N$ ↑ PARALLEL

$W = mg$

$W = (105\,kg)(9.8\,m/s^2)$

$W = 1029\,N$

$WORK = F_{||} d$

$= (1029\,N)(5\,m)$

WORK = 5,145 J

5. If it took Jack 15 seconds to reach Katie and Fluffy. How much Power did the motor have to generate?

Rubric:
____ Data
____ Equation
____ Substitution
____ Answer
____ Units

WORK = 5145 J
Δt = 15 s

$$\text{POWER} = \frac{\text{WORK}}{\Delta t}$$

$$= \frac{5145\ \text{J}}{15\ \text{s}}$$

P = 343 WATTS

6. Katie and Fluffy jump into the bucket with Jack. Jack guides the bucket down to safety. How much work did the motor have to do to get them all down? **Draw a free-body diagram.**

Hints:
a) Find the Weight of all of them first
b) The Applied Force (F) is equal to the weight of them all.

Rubric:
____ FBD
____ Data
____ Equation
____ Substitution
____ Answer
____ Units

TOTAL WEIGHT = 14.7N (FLUFFY) + 294N (KATIE) + 1029N (JACK) = 1337.7 N↓

F = 1337.7 N↑
d = 5 m↑ PARALLEL

WORK = F∥d
= (1337.7 N)(5 m)

WORK = 6688.5 J

7. Jack, the hero, jumps back into his 9,000-kg truck and drives into the sunset (back to the station). He drives 5,000 meters horizontally and 20 meters vertically to get back to the station. There is a horizontal Drag Force on the truck of 200 N. How much work did the truck motor have to do to get Jack back to the station? **Draw a free-body diagram.**

Rubric:
___ FBD
___ Data
___ Equation
___ Substitution
___ Answer
___ Units

Hints:
a) Find the work horizontally and vertically separately. Then add both together.

HORIZONTAL

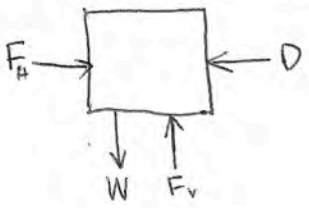
$d_H = 5000\ m \rightarrow$
$DRAG = 200\ N \leftarrow$ PARALLEL
$F_H = 200\ N \rightarrow$

$WORK = F_{\parallel} d$
$= (200\ N)(5000\ m)$
$WORK_H = 1{,}000{,}000\ J$

VERTICAL

$m = 9000\ kg$
$W = mg = (9000\ kg)(9.8\ m/s^2)$
$W = 88200\ N \downarrow$
$F_V = 8820\ N \uparrow$
$d_V = 20\ m \uparrow$ PARALLEL

$WORK = F_{\parallel} d$
$= (8820\ N)(20\ m)$
$WORK_V = 176{,}400\ J$



TOTAL WORK = (WORK H) + (WORK V)

TOTAL WORK = 1,000,000 J + 176,400 J

TOTAL WORK = 1,176,400 J

8. If it took Jack 6 minutes to reach the station. How much Power did the truck motor have to generate?

Hint:
a) Convert minutes to seconds.

Rubric:
___ Data
___ Equation
___ Substitution
___ Answer
___ Units

$\Delta t = \frac{6\ \text{MIN}}{1} \times \frac{60\ sec}{1\ \text{MIN}} = 360\ s$

$WORK = 1{,}176{,}400\ J$

$POWER = \frac{WORK}{\Delta t}$

$POWER = \frac{1{,}176{,}400\ J}{360\ s}$

$POWER = 3267.78\ W$